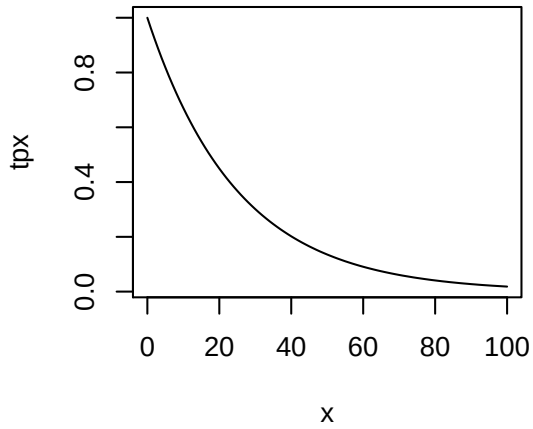
1 Survival Models

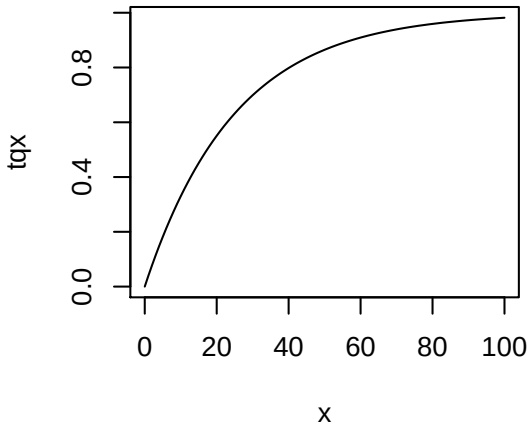
By overriding the force of mortality and global parameters, we can use makehams to implement a variety of survival models. For instance, it is possible to use a constant force of mortality, μ or a uniform pdf for $T(x)$.

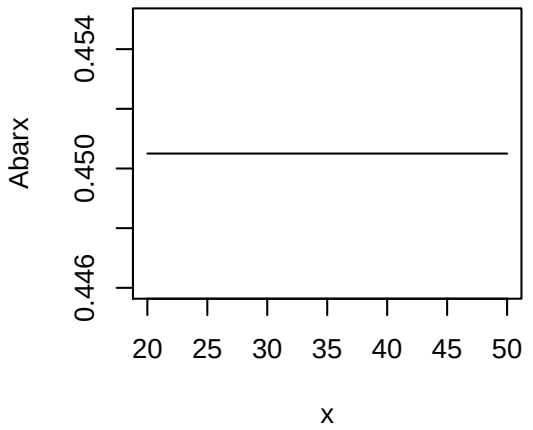
1.1 Constant force of mortality

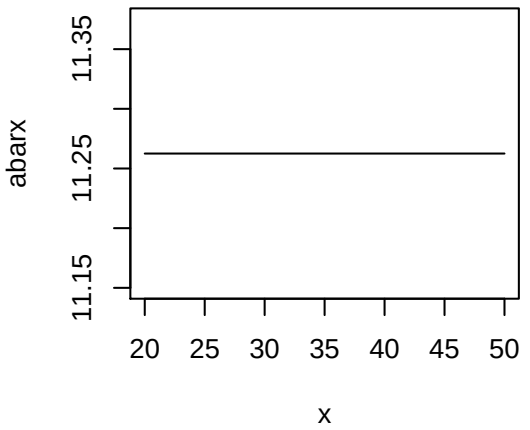
For CFM, use the `cfm` function

```
> library(makehams)
> cfm()
> tpx(5,20)

[1] 0.8187308

> Ax(20,c=1)

[1] 0.4505003

> annx(20,c=1)

[1] 11.26251

> Ax(x=21,c=1) - annx(x=21,c=1)*Ax(x=20,c=1)/annx(x=20,c=1)

[1] -5.551115e-17

> thV(t=0,h=1,s=0.05)

[1] 0

> par(mfrow=c(2,2))
> plot(tpx, 0, 100)
> plot(tqx, 0, 100)
> plot(function(x) sapply(x, function(s) Ax(s,c=1)), 20, 50, ylab="Abarx", xlab="x")
> plot(function(x) sapply(x, function(s) annx(s,c=1)), 20, 50, ylab="abarx", xlab="x")
```


tpx
0.0
0.4
0.8
0
20
40
60
80
100
x


tqx
0.0
0.4
0.8
0
20
40
60
80
100
x

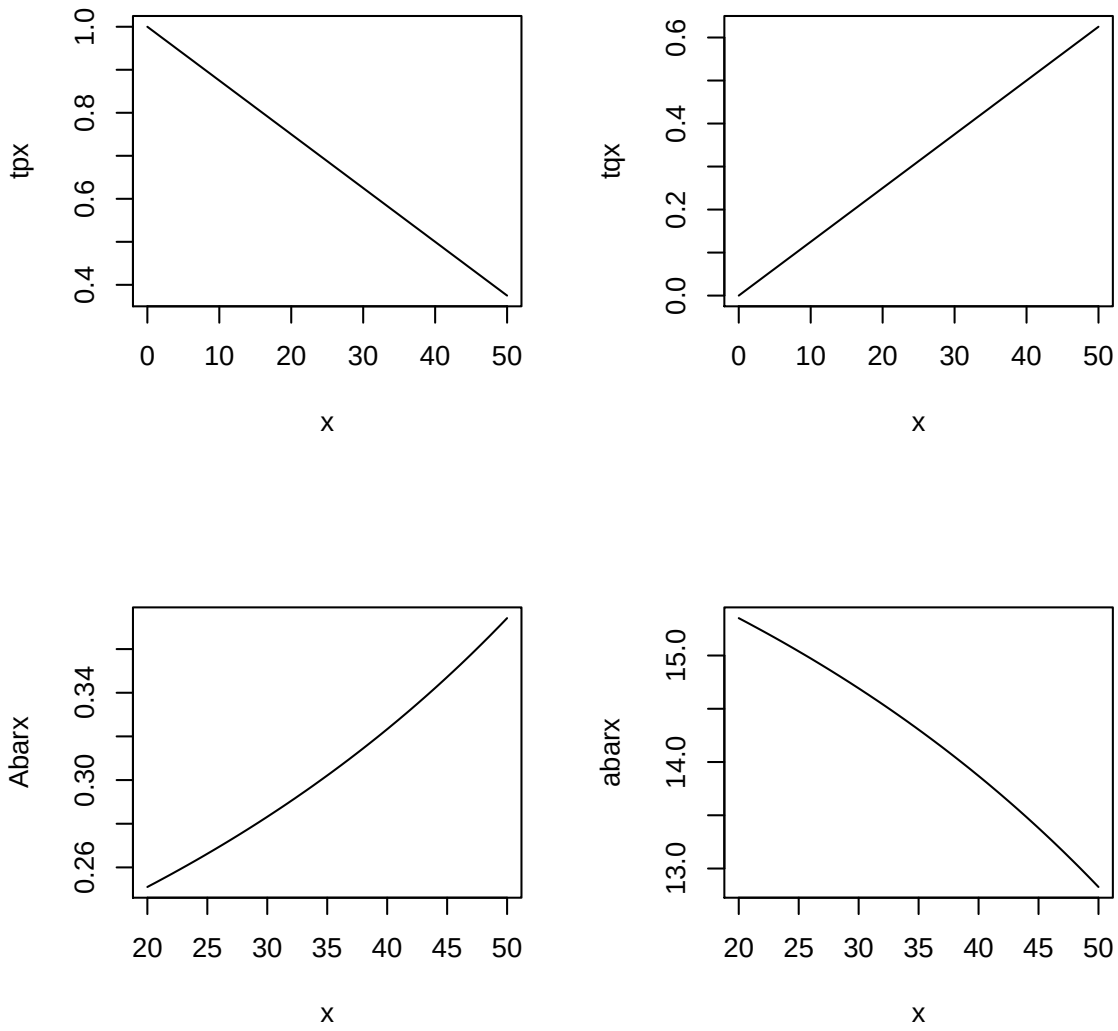

Abarx
0.446
0.450
0.454
20
25
30
35
40
45
50
x


abarx
11.15
11.25
11.35
20
25
30
35
40
45
50
x

1.2 De Moivre's Law

For De Moivre's Law, we can use the `demoivres` function

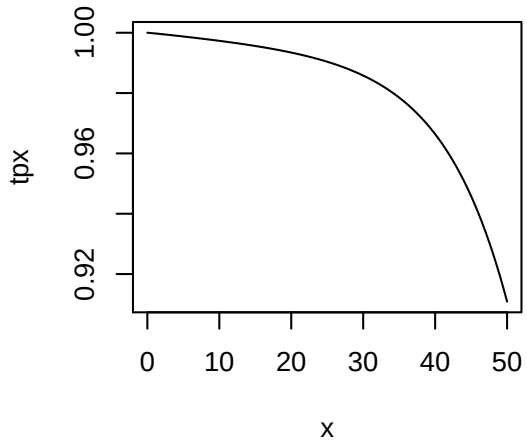
```
> demoivres()
> tpx(5,20)

[1] 0.9375

> Ax(x=20,c=1)

[1] 0.2510299

> annx(x=20,c=1)

[1] 15.35084

> Ax(x=21,c=1) - annx(x=21,c=1)*Ax(x=20,c=1)/annx(x=20,c=1)

[1] 0.003893153

> thV(t=0,h=1,s=0.05)

[1] 0.003891068

> par(mfrow=c(2,2))
> plot(tpx, 0, 50)
> plot(tqx, 0, 50)
> plot(function(x) sapply(x, function(s) Ax(s,c=1)), 20, 50, ylab="Abarx", xlab="x")
> plot(function(x) sapply(x, function(s) annx(s,c=1)), 20, 50, ylab="abarx", xlab="x")
```

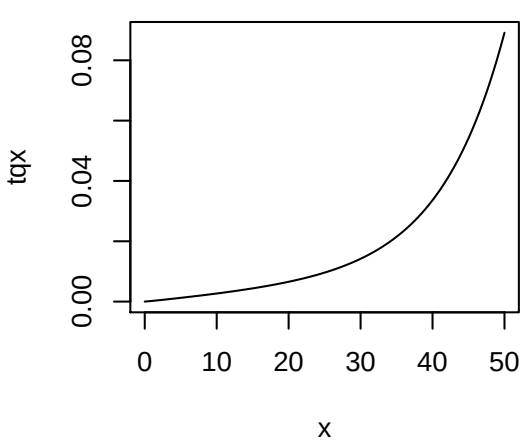

tpx
0.4
0.6
0.8
1.0
0
10
20
30
40
50
x
tqx
0.0
0.2
0.4
0.6
0
10
20
30
40
50
x
Abarx
0.26
0.30
0.34
20
25
30
35
40
45
50
x
abarx
13.0
14.0
15.0
20
25
30
35
40
45
50
x

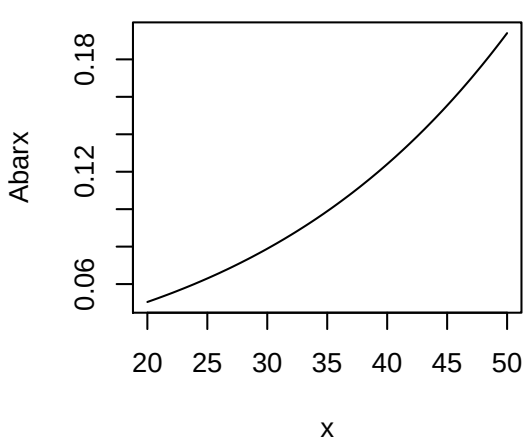
1.3 Makeham's Law

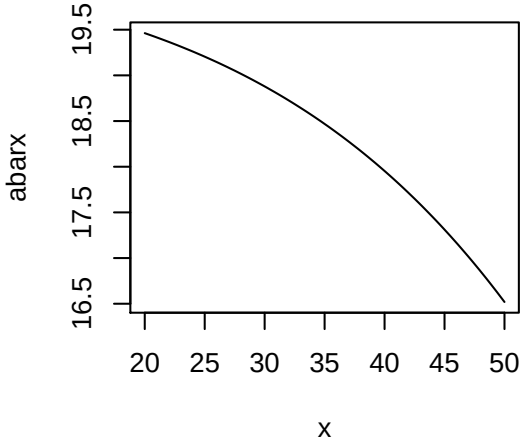
For Makeham's Law, we can use the `makehams` function

```
> makehams()
> tpx(5,20)

[1] 0.9987601

> Ax(x=20,c=1)

[1] 0.05043333

> annx(x=20,c=1)

[1] 19.46226

> Ax(x=21,c=1) - annx(x=21,c=1)*Ax(x=20,c=1)/annx(x=20,c=1)

[1] 0.002400081

> thV(t=0,h=1,s=0.05)

[1] 0.002434979

> par(mfrow=c(2,2))
> plot(tpx, 0, 50)
> plot(tqx, 0, 50)
> plot(function(x) sapply(x, function(s) Ax(s,c=1)), 20, 50, ylab="Abarx", xlab="x")
> plot(function(x) sapply(x, function(s) annx(s,c=1)), 20, 50, ylab="abarx", xlab="x")
```


tpx
1.00
0.96
0.92
0
10
20
30
40
50
x


tqx
0.08
0.04
0.00
0
10
20
30
40
50
x


Abarx
0.18
0.12
0.06
20
25
30
35
40
45
50
x


abarx
19.5
18.5
17.5
16.5
20
25
30
35
40
45
50
x